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The fangs of *Dispholidus typus* Smith and *Thelotornis kirtlandii* Smith (Serpentes: Colubridae)

by

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With 4 figures

Abstract

Dispholidus typus and *Thelotornis kirtlandii* are the only opisthoglyphous snakes of the family *Colubridae* known to date, of which bites have been fatal to man. Both species possess three fangs on each maxillary bone, two of which are probably functional, the third one being possibly in replacement. The fangs not only show a deep venom groove, but, moreover, this groove passes into a blade-like ridge at the mesial apex, apparently enabling the venom to flow more efficiently into the wound.

INTRODUCTION

Snakes of the family *Colubridae*, including those that are opisthoglyphous, are generally not dangerous to humans because they rarely insert the posterior maxillary teeth into human skin when biting in defense. On the other hand, bites from some fifteen of these colubrid snakes are known to cause clinical symptoms in man. Fatal cases reported so far however could only be attributed to the aglyphous Japanese species *Rhabdophis tigrinus* (one fatal case; Mittleman & Goris 1978) and to two opisthoglyphous African species, to *Dispholidus typus*, the Boomslang, and to *Thelotornis kirtlandii*, the Twig or Vine snake (Mebs 1977). *D. typus* is wide-spread throughout the African continent, occuring in the savannah country from Senegal to Eritrea in the north and to the Cape peninsula in the south. *T. kirtlandii* is found from tropical Africa southwards to the northern half of South West Africa in the west and to Natal and Transvaal in the east (Fitzsimons 1962). At least six fatal cases assigned to *D. typus* (Mebs 1977)

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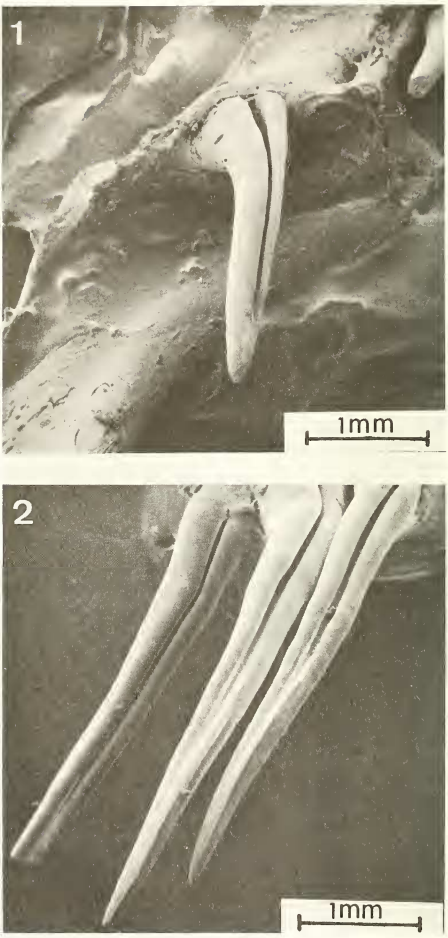

FIG. 1. — *Rhamphiophis oxyrhynchus*
Fang on the right maxillary bone.

FIG. 2. — *Dispholidus typus*
Three fangs on the right maxillary bone with the blade-like ridge at the front-side apex. Top of the largest fang is broken.

and two fatal cases assigned to *T. kirtlandii* (Broadley 1957, Fitzsimons & Smith 1958, Mebs *et al.* 1978) have been described. It is very difficult to specify the real mortality rate, for in many African countries medical care is uneven and statistics are seldom available. In these tree living species the anterior half of their head seems somewhat shorter than usual in colubrid snakes, the rear fangs are located comparatively far forewardly, underneath the eyes and the fangs of *D. typus* have a blade-like ridge along one side of the groove (Freyvogel 1972). Although the venom itself is very potent, with strong haemotoxicity (FitzSimons 1962) these morphological particularities may enhance the severity of envenomations described in the literature. In the present paper, the fangs of *D. typus* and *T. kirtlandii* are studied by Scanning Electron Microscopy and compared to those of *Rhamphiophis oxyrhynchus*, a comparatively harmless opisthoglyphous colubrid snake.

MATERIAL AND METHODS

Maxillary bones were taken out of a *D. typus*, a *R. oxyrhynchus* and a *T. kirtlandii*, cleansed in a 5% H_2O_2—solution, air dried and coated with gold. Scanning Electron Micrographs were made with a Cambridge Stereoscan Mark 2 A at the SEM—Laboratory of Basle University.

RESULTS AND DISCUSSION

R. oxyrhynchus (fig. 1) shows a single grooved rear fang on each maxillary bone. *D. typus* as well as *T. kirtlandii* show three fangs on each maxillary bone, one in replacement, two probably functional. As mentioned by Phisalix (1922), one or two fangs on a maxillary bone of opisthoglyphous species are common but three fangs occur very rarely. Not only *D. typus* (fig. 2) but also *T. kirtlandii* (fig. 3) show a venom groove passing into a blade-like ridge at the fang's apex. Taub (1967) pointed out that a well developed Duvernoy's gland was not always accompanied by grooved fangs. Two or more enlarged ungrooved teeth in the region of the gland's duct have a similar effect as a single grooved fang. He states that *D. typus* has the most advanced Duvernoy's gland. Our investigation shows that as *D. typus* as *T. kirtlandii* from a toxinological view probably have the most advanced grooved fangs of colubrid snakes and posses dental ridges on the mesial apex (fig. 2, 3 and 4) (Edmund 1969). Little work has been published on the function of dental ridges: Frazzetta (1966) proposed that the dental ridges ("cutting" edges) in pythons function to cut the teeth free from the prey during jaw opening and therefore aid in tooth disengagement. Wright *et al.* (1979) examining the teeth of the aglyphous *Thamnophis elegans* found long dental ridges along the distal and mesial side of the tooth's curvature.

They conclude that the distal ridges serve while the mouth is closing and therefore more likely function to aid in tooth engagement. Thus, Kardong (1980) considered that jaw closure followed by retraction imparts two motions to the posterior teeth: the first motion results in tooth puncture and the second in a cutting stroke. In *D. typus* and in *T. kirtlandii* however, the ridges seem to serve another function. As seen in figure 4, the blade-like ridge lies in line with the groove, as if to serve as its prolongation.

This alignment of the ridge with the groove suggest that the dental ridge in *D. typus* and *T. kirtlandii* functions to make venom injection easier. It seems that the ridge functions to diminish the tissue's resistance and therefore allows the venom to be injected more efficiently.

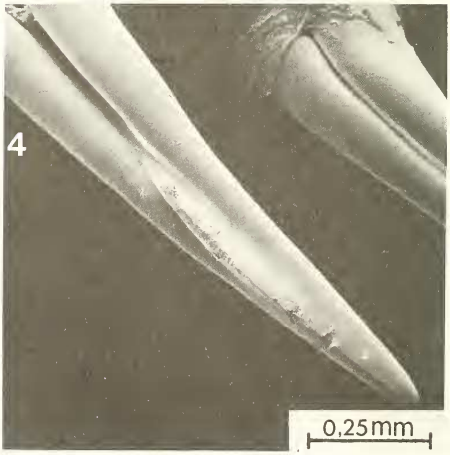

FIG. 3. — *Thelotornis kirtlandii*
Fangs on the left maxillary bone.
The third fang is missing.

FIG. 4. — *Thelotornis kirtlandii*
"Inverted prolongation" of the groove.

D. typus and *T. kirtlandii* are very well adapted to an arboreal life. Resting quite motionless on a tree with much of the forepart unsupported, the snake waits for its prey, which consists of chameleons and other tree dwelling lizards, as well as mice and occasionally toads and frogs. Before being swallowed, the seized prey is firmly held in the jaws for some fifteen minutes (FITZSIMONS 1962). The jaws must therefore be able to hold the prey firmly and inject the venom efficiently. This is achieved by the cranial modifications mentioned by FREYVOGEL (1972) and the blade-like ridges. This applies equally to *D. typus* and *T. kirtlandii*, both snakes dangerous to man, but not to the comparatively harmless *R. oxyrhynchus*. Thus, we consider that the blade-like ridge and the number of the fangs of *D. typus* and *T. kirtlandii* render the whole venom apparatus more efficient. This may explain, in part, the danger of severe or fatal envenomation of man, although *D. typus* and *T. kirtlandii* are anything but aggressive snakes.

ZUSAMMENFASSUNG

Die bis heute einzig bekannten opisthoglyphen Vertreter der Nattern *(Colubridae)*, deren Bisse auch beim Menschen Todesfälle herbeiführen können, sind *Dispholidus typus* und *Thelotornis kirtlandii*. Beide Arten tragen auf jedem Maxillarknochen drei Giftzähne, wovon vermutlich zwei funktionsfähig sind und der dritte als Ersatzzahn anzusehen ist. Die Giftzähne besitzen nicht nur eine tiefe Giftrinne; vielmehr geht diese in eine messerartige Struktur über, welche wohl das Einfliessen des Giftes in die Wunde erleichtert.

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